

A DOLPHIN (*STENELLA ATTENUATA*) FROM DURBAN,
SOUTH AFRICA

By

PETER B. BEST

South African Museum, Cape Town

(With plates 11-17 and 1 figure)

[MS. received 15 January 1968]

CONTENTS

	PAGE
Introduction . . .	121
External appearance . .	121
Skeleton . . .	124
Additional notes . . .	133
Summary . . .	133
Acknowledgements . .	134
References . . .	134

INTRODUCTION

On 4 July 1964, a female dolphin seven feet and half an inch long was stranded on Battery Beach, Durban, South Africa. Mr. J. Wallace of the Oceanographic Research Institute recognized the unusual appearance of the specimen and so preserved it entire in a deep-freeze. With the kind co-operation of the Institute, this dolphin was eventually presented to the South African Museum (catalogue number 35515) in September 1966, where on examination it proved to be a specimen of the narrow-snouted dolphin *Stenella attenuata* (Gray, 1846), the first recorded from South Africa for nearly 100 years.

EXTERNAL APPEARANCE

Colour pattern. Mr. Wallace took several black and white photographs of the specimen while it was still fresh, and also made a pencil sketch of the distribution of pigment. Although the dolphin was subsequently in a frozen state for over two years, and was in fact pure black on arrival at the museum, immersion in water rapidly caused most of the original colour pattern to reappear. The distribution of pigment, therefore, has been accurately recorded, but less confidence can be placed in the colour tones attributed to these pigmented areas after two years in cold storage.

The dolphin was basically a dark slate-grey above and a light slate-grey below, the border between the two being fairly sharply defined in the anterior half of the body but less defined in the area behind the dorsal fin (fig. 1). A light grey band began just behind the apex of the melon and ran back above the eye,

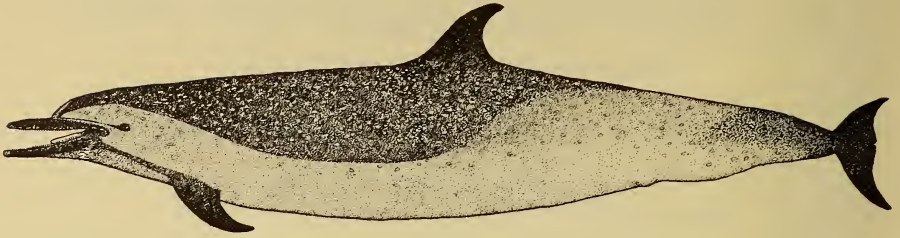


Fig. 1

where it joined a similar-coloured band from the angle of the gape. This common band then passed back above the flipper, subsequently spreading out to cover the entire ventral surface as far as the base of the tail. There was no darkening or lightening of the grey pigment along the centre of the belly. The upper border of the light grey area continued along the body from the side of the head in a gradually downward-curving sweep, which in the region between flipper insertion and dorsal fin levelled out more than half-way down the side. Thereafter it curved up sharply at the level of the dorsal fin, the grey colour from each side meeting over the back about half-way between the dorsal fin and the tail. The portion of the back just anterior to the tail-stock, however, was dark slate-grey, giving the area of light grey pigment behind the dorsal fin the appearance of an upward-curving band. The remainder of the upper and lower surfaces of the tail flukes was dark slate-grey.

Both surfaces of the flippers were similarly coloured, and a dark streak ran from the flipper insertion to just below the angle of the gape, whence it extended as a black margin along the lower jaw to meet the corresponding band of the other side towards the jaw tip. The eye was ringed with dark slate-grey, and this extended forward as a narrow streak along the base of the melon. From each side of the apex of the melon a light grey streak ran back to the lateral margin of the blowhole, narrowing all the way.

The throat was chiefly light slate-grey in colour, but with yellowish-pink mottling extending as a widening band from each angle of the gape, forming a 'bridle' round the throat. The extreme tips of both upper and lower jaws were yellow-grey flecked with black, as were the inner margins of the lips and the palate, where the black flecks were larger. The tongue was a bright pink.

Small white flecks, mostly elongated in an anterior-posterior direction, and on average about three-sixteenths of an inch in diameter, were scattered over most of the body surface. They were less abundant on the throat and belly as far as the genital aperture, but were particularly numerous on the sides behind the dorsal fin and on the ventral caudal peduncle. There were no such markings on the rostrum or either side of the flippers and tail flukes, but there were a few at the base of the dorsal fin. A narrow area on the back from head to dorsal fin was also largely devoid of flecks.

Although the colour pattern in many *Stenella* species is either unknown or poorly described, this specimen was clearly separate from forms which are

typified by a dark stripe down the side, such as *S. euphrosyne*, *S. lateralis*, *S. caeruleoalba* and *S. styx*. It also seemed distinct from *S. plagiodon*, which has a pure white belly and no stripe from the flipper to the angle of the mouth, and *S. graffmani*, which is coal black all over except for many whitish-grey spots, particularly on the back. Among other forms in which the colour pattern is known in some detail, the specimen most closely resembled *S. frontalis*, as described by Fraser (1950), and *S. attenuata*, as described by Nishiwaki, Nakajima & Kamiya (1965).

The colour description of the *Atlantide* dolphin, identified by Fraser (1950) as *S. frontalis*, agreed closely with the Durban specimen in both the distribution of major pigment zones and the colour values assigned to them. Thus the *Atlantide* dolphin was described as black above and a dark grey below, the boundary between the two zones following the same curve down the body as in the Durban specimen. The colour of the dorsal fin, tail flukes and flippers was identical in the two animals, and the *Atlantide* dolphin also had a dark stripe from the flipper to the angle of the mouth, and a dark ring round the eye which extended forward to the base of the snout. Similar irregular light grey flecks covered the back, and white flecks were present on the belly.

The two specimens differed, however, in the colour of the snout and lower jaw. Whereas the *Atlantide* dolphin had the distal third of the snout whitish-pink in colour, only the extreme tip of the snout of the Durban dolphin was light in colour, being a yellowish-grey flecked with black. Similarly, the forward end of the lower jaw was described as white with dark spots posteriorly in the *Atlantide* dolphin, whereas the Durban specimen only had the extreme tip of the lower jaw yellowish-grey flecked with black. In both dolphins, however, the light colour anteriorly was continued as a narrow band along the margin of upper and lower jaws as far as the angle of the gape.

The band of yellowish-pink mottling on the throat of the Durban specimen was absent in the *Atlantide* dolphin.

Apart from these differences in the colour of the snout and lower jaw, the only other features of body coloration that differed were the presence of abundant dark spots on the belly and a narrow band of lighter grey mid-ventrally, both of which were present on the *Atlantide* dolphin but not seen on the Durban dolphin.

Nishiwaki, Nakajima & Kamiya (1965) described a number of dolphins from Arari, Japan, which they identified as *S. attenuata*. The colour pattern as figured and described for these dolphins agreed in almost every detail with that of the Durban specimen. The only discernible difference appeared to be in the extent of light pigment on the snout and lower jaw, which was greater in the Arari dolphins but at the same time was considerably less than in the *Atlantide* dolphin. Nevertheless, this was a variable feature, Nishiwaki *et al.* remarking that such white tips to the snout were absent in foetuses and new-born calves. Consequently both the Arari and Durban dolphins differed from the *Atlantide* specimen in the extent of white on the snout, in having a 'bridle' of light

mottling, and in lacking dark spots on the belly and a lighter mid-ventral area. *Body proportions.* In general shape the Durban dolphin resembled many other species of *Stenella* and *Delphinus* in possessing a slender, streamlined body, a narrow beak clearly separated from the rest of the head, small curved flippers and a centrally-placed, recurved dorsal fin. A series of 32 body measurements were made of the Durban specimen, and these, expressed as percentages of the body length, have been compared with similar measurements recorded for the *Atlantide* dolphin (Fraser, 1950) and for the Arari dolphins (Nishiwaki *et al.*, 1965) in table 1.

All but two measurements of the Durban dolphin fell within the range of the Arari dolphins, but in nearly every case they were nearer the lower end of the range. The two exceptions were the length of the dorsal fin base and the width of the tail flukes, the first of which was less and the second of which was greater than that recorded for any Arari dolphin. The base of the dorsal fin in the Durban dolphin was prolonged posteriorly as a narrow ridge along the caudal region, and so its actual length was extremely hard to judge. For this reason the posterior end of the base was arbitrarily fixed as that point immediately below the tip of the dorsal fin, and so this measurement was probably not directly comparable to that recorded for the Arari or *Atlantide* dolphins. The relative width of the tail flukes in other dolphins is known to increase with the size of the animal, and as the Durban specimen was larger than any measured at Arari this probably accounts for the greater width of the tail flukes. In most respects, therefore, the Durban dolphin could be considered as indistinguishable in body proportions from those collected at Arari.

Ignoring the length of the dorsal fin base, the *Atlantide* dolphin apparently differed from both the Durban and Arari dolphins in having a shorter beak (measurement number 3) and an anus situated farther forward. However, the position of the latter was fixed differently in the *Atlantide* specimen, the measurement being taken from the notch of the flukes rather than from the tip of the snout, and this may have introduced some disparity. Nevertheless, the *Atlantide* dolphin seems to be clearly separated from the Durban and Arari dolphins by its shorter beak.

SKELETON

Skull. The skull and mandibles of the Durban dolphin are shown in plates 11 and 12.

The right premaxilla extended back about 15 mm farther than the left, and was considerably wider at its termination. Unlike the *Atlantide* dolphin, neither premaxilla came into contact with the nasal bones posteriorly, there being a clear wedge of the maxillary bone 4 to 5 mm wide between the tip of the right premaxilla and the nasal. As in the *Atlantide* dolphin, the prenasal triangle was concave and the apical portions roughened. The lateral margins of the triangle were also elevated above and overhung the adjacent areas of the maxillae, particularly at the level of the anterior margin of the superior nares,

Measurement	Durban dolphin		<i>Atlantide</i> dolphin (<i>S. frontalis</i>) Fraser, 1950		Arari dolphins (<i>S. attenuata</i>) Nishiwaki <i>et al.</i> , 1965	
	in.	%	in.	%	in.	%
1. Total length	84.5	100	84.5	100	—	—
2. Tip of snout to centre of eye	12.0	14.2	14.3	16.9	13.5-16.3	15.3
3. Tip of snout to apex of melon	4.5	5.3	4.5	5.3	5.3-6.4	5.9
4. Tip of snout to blowhole	12.5	14.8	14.8	17.6	14.2-17.1	15.6
5. Tip of snout to angle of gape	10.3	12.2	12.0	14.2	11.0-14.4	12.9
6. Tip of snout to anterior insertion of flipper	15.8	18.7	19.1 ¹	22.6	—	—
7. Tip of snout to tip of dorsal fin	48.5	57.4	—	—	—	—
8. Tip of snout to centre of genital aperture	59.5	70.4	—	—	—	—
9. Tip of snout to centre of anus	62.3	73.7	70.0 ²	82.3	73.5-74.8	74.3
10. Centre of eye to angle of gape	2.3	2.7	—	—	—	—
11. Centre of eye to centre of blowhole	5.8	6.9	—	—	—	—
12. Projection of lower jaw beyond upper	0.3	0.4	c. 0.25	—	—	—
13. Girth, at axilla	36.0	42.6	—	—	—	—
14. Girth, maximum (3 feet from snout)	40.5	47.9	46.5 ³	—	—	—
15. Girth, at anus	24.3	28.8	—	—	—	—
16. Flipper, anterior insertion to tip	10.8	12.8	12.0	14.2	14.4-15.1	14.8
17. Flipper, axilla to tip	7.4	8.8	8.5	10.1	10.1-10.7	10.4
18. Flipper, maximum width	3.6	4.3	4.5	5.3	5.0-5.3	5.2
19. Dorsal fin, height	7.1	8.4	8.0	9.6	8.2-9.7	9.0
20. Dorsal fin, length of base	10.0 ⁴	11.8	16.5	19.4	12.1-14.4	13.5
21. Tail flukes, width, tip to tip	20.0	23.7	22.0	26.4	21.6-22.5	22.1
22. Tail flukes, notch to nearest point on anterior border	4.5	5.3	—	—	—	—
23. Tail flukes, depth of notch	0.9	1.1	—	—	—	—
24. Eye, height	0.5	0.6	—	—	—	—
25. Eye, length	1.0	1.2	—	—	—	—
26. Right mammary slit, length	1.1	1.3	—	—	—	—
27. Left mammary slit, length	1.0	1.2	—	—	—	—
28. Ano-genital slit, length	6.0	7.1	—	—	—	—
29. Ano-genital slit, length including anterior groove	9.3	11.0	—	—	—	—
30. Anal opening, length	0.8	0.9	—	—	—	—
31. Blowhole, width	1.0	1.2	—	—	—	—
32. Blowhole, length	0.4	0.5	—	—	—	—

¹ Obtained by subtracting length of flipper from distance 'tip of snout to tip of flipper'. ² Obtained by subtracting distance 'notch of flukes to anus' from total length. ³ Site of measurement not recorded. ⁴ Distance from anterior insertion of dorsal fin to point vertically below fin tip (see text).

where they formed distinct promontories. The smooth rostral portions of the premaxillae were arched more prominently than either their roughened lateral portions or the adjacent maxillae. At the base of the rostrum the lateral margins of the maxillae were raised into a roughened ridge, as described for the *Atlantide* dolphin.

The palate conformed to the normal *Stenella* pattern in lacking a pair of longitudinal grooves. At its extreme anterior tip the palate was concave, and in profile curved slightly downward. The central region, however, was noticeably concave, bearing a strong median groove, but this closed up about 30 mm anterior to the hindmost tooth. The palate was then almost flat, but thereafter the centre rose rapidly as a prominence bearing the pterygoid bones. The pterygoids were closely apposed in the midline, their posterior margin being roughly bracket-shaped. The ventral surface of each bone was raised into a slight ridge which diverged posteriorly and became less prominent on the pterygoid wing. These ridges did not seem to be as well developed as in the *Atlantide* dolphin, and were placed nearer the midline. The inner edge of each tooth alveolus was raised up as a little cone-like ridge, and these formed a more or less continuous band along the whole tooth-row, being marked off anteriorly from the rest of the maxilla by a shallow groove.

The lower jaws were not ankylosed at the symphysis. The mandibular rami in lateral view seemed to be more curved than those figured for the *Atlantide* dolphin, and the tips were more tapered.

The dental formula, expressed in such a way as to indicate the normalized teeth and the smaller anterior teeth, was

$$\begin{array}{cc} \text{R } \frac{37+4}{38+2} & \text{L } \frac{37+4}{37+2}, \end{array}$$

which hardly differed from that of the *Atlantide* dolphin, and fell well within the range of $\frac{38-45}{36-43}$ given for the Arari dolphins.

A series of 20 measurements were made of the skull and mandibles of the Durban dolphin (table 2).

In a comparison of the skull of the *Atlantide* dolphin with 30 other similar specimens, among them the types of *Delphinus attenuatus*, *Steno capensis*, *Delphinus doris*, *Delphinus frontalis* and *Delphinus fraenatus*, Fraser (1950) was able to separate the skulls into two groups from the shape of the rostrum distally: this was best expressed by the width of the rostrum at a quarter its length from the tip. One of these groups, including the types of *frontalis*, *fraenatus* and *doris* and the *Atlantide* specimen, could be distinguished by a distinctive range in six other measurements from the second group which included the types of *attenuatus* and *Steno capensis*. In this way it was possible to state that in the *frontalis* group the rostrum at the middle, the zygomatic, preorbital, postorbital widths and the premaxillary width proximally were all greater than in the *attenuata* group, and the height of the mandible at the coronoid process also seemed to be greater in the *frontalis* group.

TABLE 2

Skull measurements of the Durban dolphin with those of *S. attenuata*, *S. frontalis* and *S. cf. capensis* for comparison.

Measurement	Durban dolphin		Avari dolphins (<i>S. attenuata</i>) Nishiwaki <i>et al.</i> , 1965		<i>S. attenuata</i> group Fraser, 1950		<i>S. frontalis</i> group Fraser, 1950		<i>S. cf. capensis</i> (St. Helena) Fraser, 1966	
	mm	%	Range	Mean	Range	%	Range	%	Range	Mean
1. Total length	415	100	—	100	—	100	—	100	—	100
2. Rostrum length	251	60.5	57.8-61.5	59.9	59.5-61.9	61.1	56.2-60.0	57.9	56.7-61.3	58.7
3. Rostrum width at base	87	21.0	21.5-23.3	22.4	19.9-22.3	21.1	20.3-24.0	22.1	20.0-23.9	21.6
4. Rostrum width at middle	45	10.8	10.8-12.1	11.3	9.0-10.9	9.9	11.1-13.8	12.3	—	—
5. Rostrum width 60 mm in front of antorbital notches	62	14.9	14.2-15.4	14.9	13.0-15.8	14.0	14.2-17.2	15.6	13.2-16.1	14.2
6. Rostrum width $\frac{2}{3}$ length	32	7.7	7.5-8.1	7.7	6.1-7.1	6.6	7.9-10.1	8.9	—	—
7. Preorbital width	154	37.1	38.7-42.8	40.0	35.4-38.2	36.8	38.4-42.7	40.3	35.6-42.0	38.0
8. Postorbital width	177	42.7	42.2-45.9	43.7	39.5-42.9	41.2	43.7-47.7	45.4	40.7-45.1	42.7
9. Zygomatic width	177	42.7	37.3-42.6	39.7	39.4-42.1	40.9	43.4-47.7	45.2	39.7-45.1	42.4
10. Parietal width	138	33.3	35.3-39.1	36.8	32.1-36.3	34.0	34.1-39.5	37.1	32.3-39.1	35.2
11. Maximum width of premaxilla proximally	68	16.4	16.6-18.4	17.6	15.5-16.7	16.0	17.4-21.0	18.6	15.8-18.4	17.0
12. Tip of rostrum to ant. margin superior nares	289	69.6	68.0-70.5	69.3	68.9-72.4	71.1	65.8-69.6	67.5	—	—
13. Tip of rostrum to end of pterygoid	299	72.1	70.1-73.0	71.4	69.7-73.2	71.7	67.6-71.2	69.6	—	—
14. Temporal fossa, length	70	16.9	13.4-14.7	14.1	14.4-18.2	15.9	15.2-19.3	17.1	—	—
15. Temporal fossa, height	56	13.5	8.1-10.2	9.0	10.2-13.7	11.6	11.5-15.3	12.9	—	—
16. Hinder end of tooth row to tip of premaxilla (R)	216	52.1	48.7-52.6	51.0	51.5-53.4	52.4	46.3-52.5	49.9	{ 47.0-53.5	50.0
do. (L)	217	52.3	48.0-52.3	50.9	—	—	—	—	{ 47.0-53.0	49.9
17. Mandible length (R)	347	83.6	83.8-90.3	85.8	84.2-85.8	84.9	81.3-86.3	84.3	{ 82.1-88.3	84.4
do. (L)	347	83.6	84.1-89.8	85.8	—	—	—	—	{ 81.6-88.0	84.5
18. Coronoid height (R)	62	14.9	14.3-15.4	14.8	13.5-14.6	14.0	14.7-16.4	15.4	{ 13.6-16.4	14.6
do. (L)	61	14.7	14.0-15.2	14.7	—	—	—	—	{ 13.2-16.0	14.4
19. Hinder end of tooth row to tip of mandible (R)	207	49.9	49.3-51.6	50.5	49.1-52.6	50.9	46.9-52.0	48.7	{ 46.7-53.5	49.4
do. (L)	208	50.1	49.5-51.9	50.5	—	—	—	—	{ 46.1-53.5	49.2
20. Length of symphysis	81	19.5	16.0-18.8	17.3	—	—	—	—	{ 13.6-19.2	16.7

¹ Maximum reading for each specimen, whether right or left.

When the measurements of the skull and mandibles of the Durban specimen, expressed as percentages of the skull length, were compared with those recorded for the *frontalis* and *attenuata* groups by Fraser (1950), it was immediately obvious that the specimen had a greater affinity to the *attenuata* group. Of 18 of the measurements, nine fell exclusively within the range recorded for the *attenuata* group, while five were shared by both groups. Only two measurements (numbers 17 and 18) fell exclusively within the range of the *frontalis* group, both being measurements referring to the mandible. However, two of the skull proportions used by Fraser to distinguish between the two groups, the zygomatic width and the rostrum width at three-quarters of its length, fell between the ranges for *frontalis* and *attenuata*.

When the skull measurements of seven dolphins from Arari (Nishiwaki *et al.*, 1965) were compared with the ranges recorded for the *frontalis* and *attenuata* groups, a similar overlap was found between the ranges of both groups in 13 of the 18 measurements. These included four of the proportions found by Fraser to be of diagnostic value in separating *attenuata* from *frontalis*: the rostrum width at the middle, the postorbital width, the premaxillary width proximally and the coronoid height of the mandible. Three additional measurements could be related only to the *attenuata* group, including the zygomatic width, while two were referable only to the *frontalis* range: the preorbital width and the rostrum width at three-quarters of its length.

The close similarity in external appearance between the Durban and Arari dolphins has already been established. Nevertheless, nine of the skull proportions of the Durban dolphin fell outside the range recorded for the Arari dolphins. These included three of Fraser's diagnostic measurements, the postorbital and zygomatic widths and the premaxillary width proximally. Consequently it appeared that the Durban skull bore a closer similarity to the specimens in Fraser's *attenuata* group than to the Arari dolphins. Neither the Durban nor the Arari dolphins, however, fully conformed with the skull proportions found by Fraser to be typical of *frontalis* or *attenuata*, the Arari specimens in fact appearing to occupy an intermediate position between the two groups.

Fraser (1966) has listed the skull proportions of a series of *Stenella cf. capensis* from around St. Helena in the South Atlantic. Twelve of the proportions recorded for the Durban dolphin, for which there were comparable data from St. Helena, fell within the range of the *S. cf. capensis* specimens. The only exception, the length of the mandibular symphysis, was a measurement which Fraser had stated to be only really useful for distinguishing species in which it is widely divergent. Seven of the 12 proportions in fact fell within the standard deviation of the means recorded for the St. Helena dolphins. Unfortunately, however, the external appearance of the St. Helena dolphins was unknown, but there seemed to be a close similarity between the skulls from this locality and the Durban specimen. It should be added that all of the skull proportions of *S. cf. capensis* straddled the ranges recorded for the *attenuata* and *frontalis*

groups by Fraser (1950), even in the six measurements considered by Fraser to be of value in distinguishing between *frontalis* and *attenuata*.

Vertebral column. There were 78 vertebrae, the vertebral formula being as follows—cervical 7, thoracic 16, lumbar 19 and caudal 36. This contrasted with the number given by Fraser (1950) for the *Atlantide* dolphin, 81, composed of 7 cervical, 15 thoracic, 23 lumbar and 36 caudal, but was in close agreement with the formula given for the Arari dolphins (Nishiwaki *et al.*, 1965). According to these authors individual variation in the vertebral formula was very little, the typical column consisting of 7 cervical, 15–16 thoracic, 18–19 lumbar and 37 caudal, or a total of 78 vertebrae.

The epiphyses were fused to their centra throughout the vertebral column, indicating that the Durban dolphin had attained full physical maturity.

The atlas had a breadth of 84 mm between the outer margins of the articulating surfaces. The lateral processes were 25 mm long, and the length of the neural spine from its tip to the nearest point on the anterior edge of the neural canal was 47 mm. The neural spine bore a prominent central ridge about 3 mm high (maximum), and on each dorsal extremity of the articulating surfaces there was a sharp spine 4–5 mm long which projected towards the anterior edge of the neural canal (pl. 13).

The axis was fused with the atlas, only the neural arch being free laterally, as in both the *Atlantide* and Arari dolphins. The axis had a short, pointed lateral process to each side which was directed obliquely backwards and slightly upwards. These processes measured 6–7 mm in length, and so were somewhat shorter than those described for the *Atlantide* dolphin (13 mm).

Unlike the latter specimen, both the neural arch and centrum of the third cervical vertebra were free of the axis in the Durban dolphin. Such also appeared to be the case in the Arari dolphins. Cervical vertebrae 3 to 6 all had small neural spines, whereas the neural arch of cervical 7 was not complete but had a gap mid-dorsally and thus no spine: this feature is recorded for the *Atlantide* dolphin but not for the Arari dolphins. Nevertheless, evidence given by Fraser (1950) indicated that an incomplete neural arch to cervical 7 has been recorded for *Stenella graffmani* and *Delphinus delphis*, and so has little taxonomic significance. There were short lateral processes from the base of neural arches 3, 4 and 7, with only the very slightest indications of one on vertebrae 5 and 6. The process on cervical 7 was the largest of all, and the whole of the lateral wall of the neural arch was greatly widened. Lateral processes from the side of the centrum were clearly present in cervicals 5 and 6, with the faintest trace of one on cervical 3. Cervical 7 bore a lateral process low down on the right hand side of the centrum. As in the *Atlantide* and Arari dolphins, the lateral process on cervical 6 was the largest, being directed anteriorly and 10–12 mm in length. Cervical 7 also bore a facet on the centrum for the articulation of the first rib.

The neural spines of the remainder of the vertebral column sloped backwards as far as lumbar 8 (31 in the column), the ninth being vertical (pl. 14).

From lumbar 10 to caudal 15 (57 in the column), the spines were directed anteriorly, but caudal 16 was vertical. From there till caudal 25, which was the last vertebra bearing a distinguishable neural spine, they again sloped backwards. These facts agreed closely with the description for the *Atlantide* dolphin (Fraser, 1950).

The height of the neural spines increased rapidly from thoracic 1 to 15, but then remained more or less constant at 83–85 cm until lumbar 13, when their height decreased, slowly at first but rapidly after caudal 19. The spines on the thoracic vertebrae tended to be larger than in the *Atlantide* dolphin, those on the first, second, third, tenth and last respectively being 33, 43, 51, 70 and 83 mm, as compared to 29, 37, 47, 59 and 76 for the *Atlantide* dolphin.

Metapophyses were absent on the first two thoracic vertebrae, but slight prominences appeared in the relevant position on the third. This contrasted with Fraser's (1950) statement that metapophyses were lacking from the first three thoracic vertebrae of the *Atlantide* specimen. From thoracic 4 to 7 the metapophyses were well developed and separate from the prezygapophyses, but from thoracic 8 onwards these two processes were fused and have been termed metapophyses thereafter. They were developed as far back as lumbar 7 (30 in the column), and remained only as traces from lumbar 8 to 17. Metapophyses reappeared, however, on lumbar 18, and persisted as separate processes until caudal 17 (59 in the column). From caudal 18 onwards the processes from each side tended to fuse together, and the last vertebra bearing a trace of a metapophysis was caudal 23 (65 in the column, as in the *Atlantide* dolphin). The Durban specimen, therefore, seemed to have developed metapophyses on more vertebrae than the *Atlantide* dolphin, the central area of column where they persisted only as traces being ten vertebrae as opposed to 22 vertebrae (Fraser, 1950). The Arari dolphins seemed to have a similar greater development of metapophyses from the plates figured by Nishiwaki *et al.* (1965).

Transverse processes on the first four thoracic vertebrae were almost straight transverse, but from thoracic 5 onwards they projected obliquely backwards, particularly so in the caudal region. The last traces of transverse processes were found on caudals 18 and 19 (60 and 61 in the column). Fraser (1950) found the last traces of transverse processes on the 61st and 62nd vertebrae of the *Atlantide* specimen.

Arising close to the tip of the transverse process on the last lumbar vertebra there was a prominent ridge which ran obliquely backwards. On successive posterior vertebrae this ridge was situated closer to the centrum, and from caudal 7 onwards placed on the body of the centrum, rising dorsally to occupy a position either side of the base of the neural arch. The last trace of this ridge was found on caudal 22 (or 64 in the column). On caudals 2 to 6 the ridge was accompanied by a small anterior projection to the leading edge of the transverse process. A similar ridge and process has been described for the *Atlantide* dolphin (Fraser, 1950).

Vertically perforating foramina for blood vessels started on caudal 13

(55 in the column), as compared to the 56th vertebra of the *Atlantide* specimen.

The first chevron bone was found immediately below the centrum of the 44th vertebra in the column, but appeared from its position and structure to consist of two adjacent chevron bones fused in an anterior-posterior direction. Consequently, the first caudal vertebra was considered as number 43 in the column. This first chevron bone was not fused in the midline, as has also been recorded for the Arari and *Atlantide* dolphins. The last three pairs of chevrons also consisted of two separate halves (as in the Arari dolphins), and were located on the 70th to 72nd vertebrae in the column. As a result, there must have been a total of 29 chevron bones, the first consisting of two fused together. This was closer to the total of 28 bones recorded for the Arari dolphins than to that of 24 recorded for the *Atlantide* dolphin, though in the latter case the smallest of the chevrons appeared to be absent.

Ribs. The Durban dolphin had 16 pairs of ribs, two of which were free: according to Fraser (1950), the *Atlantide* specimen had 15 pairs of ribs, one being free, and the Arari dolphins were recorded as having 15 to 16 pairs, one or two of which were free (Nishiwaki *et al.*, 1965). The first six pairs of ribs were double-headed, numbers 7 to 14 possessing only a tubercle, as in the *Atlantide* dolphin. The first pair of ribs was very strongly compressed, their transverse breadth being 14–24 mm but their thickness only 5 mm. The second pair was similarly compressed but to a lesser extent, the corresponding measurements being 14–15 mm and 5 mm. As described by Fraser (1950) for the *Atlantide* dolphin, each of the remaining ribs had a sharp, posteriorly-projecting keel on the dorsal surface which extended from the tubercle to the front where the rib bent round laterally. However, by the 13th rib this had become a mere trace, and was absent from the last three ribs.

Sternum. The sternum of the Durban dolphin consisted of two parts, the manubrium fused with the first mesosternal element, and the second mesosternal element as a separate, smaller bone (pl. 15). The third mesosternal element appeared to be absent. This contrasted with the sternum described for both the *Atlantide* and Arari dolphins, in which the manubrium, first and second mesosternal elements were fused, and in which the third mesosternal element was present as a separate bone. The manubrium of the Durban dolphin had a central foramen measuring 5.5 by 3.5 mm, similar to that figured for the Arari dolphins, whereas the *Atlantide* dolphin had no trace of a foramen. The measurements of the sternum were as follows: manubrium breadth in front of the first rib articulations 48 mm, behind these 65 mm, and between the ends of the lateral processes 76 mm. Behind these processes the manubrium was 38 mm wide. In general shape, therefore, the manubrium was very similar to that of the *Atlantide* dolphin, but was relatively wider behind the lateral processes. The first mesosternal element was about 50 mm long and 19 mm wide at the middle, and the second mesosternal element 35 mm long and 17 mm wide. Both elements were also relatively wider than in the *Atlantide* dolphin.

There were only nine pairs of sternal ribs present in the Durban dolphin, as against 11 pairs in both the Arari and *Atlantide* dolphins. This was probably correlated with the reduction of one mesosternal element in the Durban dolphin. All but the last two pairs of sternal ribs bore faceted ends which indicated that they were probably articulated with the sternum.

Hyoid bones. The basihyal was only partly fused to the thyrohyals, the basihyal length being 31 mm and its width about 28 mm. There was no median notch to the basihyal anteriorly as in the *Atlantide* dolphin, and in fact the anterior edge of the basihyal had a slight, V-shaped projection (pl. 16), a feature which was also figured for the Arari dolphins (Nishiwaki *et al.*, 1965). The basal breadth of the thyrohyal was 19 mm and its length 56 mm. The stylohyal length was 71 mm and its thickness 12 mm.

Pelvic bones. The pelvic bones were simple and rod-like in shape, measuring 69 mm in length with a transverse width of about 7 by 4 mm (pl. 16).

Scapula. The scapula was small and very similar in general outline to that figured for the Arari dolphins. The shape of the acromion, however, was different (pl. 17), its distal margin being straight and forming a much acuter angle with the axis of the acromion than that figured for either the *Atlantide* or Arari dolphins, although there is apparently considerable intra-specific variation in this feature (Fraser, 1950). The head of the coracoid was longer than that figured for the Arari dolphins, and the dorsal margin was more curved. The measurements of the scapula were as follows:

Greatest antero-posterior length—151 mm.

Height from anterior margin of acetabulum to upper margin of scapula—
103 mm.

Greatest length of acromion—37 mm.

Greatest breadth of acromion—27 mm.

Greatest length of coracoid—30 mm.

Fore limb. The flipper was of the same general outline as those figured for the *Atlantide* and Arari dolphins. The measurements of the flipper bones were as follows:

Greatest length of humerus—51 mm.

Greatest breadth of humerus distally—37 mm.

Greatest length of radius—67 mm.

Greatest breadth of radius distally—33 mm.

Greatest length of ulna—62 mm.

Transverse breadth of proximal row of carpals—61 mm.

There were three bones in the proximal carpal series, identified as the scaphoid (in contact with the radius), the lunar (in contact with both radius and ulna) and a bone in contact with the ulna which appeared to consist of the

cuneiform fused with the pisiform (pl. 17). Fraser (1950) stated that the pisiform was completely absent in the *Atlantide* dolphin. The distal series of carpals also consisted of three bones, the trapezium (in contact distally with the first metacarpal), the unciform (in contact distally with the third and fourth metacarpals) and a bone between the two in contact with the second and third metacarpals which seemed to represent the fusion of the trapezoid with the magnum. In the *Atlantide* dolphin the trapezoid was still present as a separate but very small element, whereas in the Arari dolphins the distal carpal series seemed to consist of only three bones as in the Durban dolphin.

Distal to the carpals were five metacarpals, of which the first is fused with the first phalanx in the right flipper only (pl. 16). The number of phalanges was as follows; first digit one, second digit nine, third digit six, fourth digit two and fifth digit one. Alternatively, if all the joints distal to the carpals were considered to be phalangeal, the formula became I:2, II:10, III:7, IV:3 and V:2, which compared with I:2, II:9, III:6, IV:3 and V:2 for the *Atlantide* dolphin and I:2, II:9, III:7, IV:3 and V:2 for the Arari dolphins. Intra-specific variation in the phalangeal formula, however, is known to be considerable for other odontocete species.

ADDITIONAL NOTES

The Durban dolphin was an adult female in anoestrus. There was no milk in the mammary glands, which from a histological examination proved to be in a resting state. The diameters of the uterine cornua differed considerably, the left horn (24 mm) being larger than the right horn (17 mm). This was associated with a similar difference in the size of the ovaries, the left one (3.87 g) being considerably larger than the right (1.93 g—preserved weights). As discussed by Ohsumi (1964), members of the genus *Stenella* seem to ovulate exclusively from the left ovary until about nine corpora have accumulated, when the right ovary may begin to function. This effect is responsible for the greater development of the left side of the reproductive tract in the Durban dolphin, for macroscopically the left ovary appeared to contain the scars of about 16 corpora whereas the right had none. There was no trace of a functional or recent corpus luteum, and no enlarged Graafian follicle was found.

The contents of the stomach consisted of a mass of small fish bones and one squid beak.

A post-mortem examination of the lungs revealed that the dolphin was suffering from a form of necrotizing pneumotitis at the time of death. An ulcer, probably of traumatic origin, was present in the lining of the first stomach.

SUMMARY

Evidence from the skull proportions of the Arari and St. Helena dolphins indicates that the *frontalis* and *attenuata* groups distinguished by Fraser (1950) are not as exclusive as was at first thought, and this has further complicated the identification of dolphins apparently belonging to the *frontalis/attenuata* complex.

In external appearance the Durban dolphin was closest to the Arari dolphins, although the appearance of *S. cf. capensis* from St. Helena is at present unknown. In skull proportions, however, the Durban specimen was rather different from those from Arari, was more closely related to Fraser's *attenuata* group, and was apparently closest to *S. cf. capensis* from St. Helena. Data from the post-cranial skeleton is difficult to evaluate because so little is known of the amount of intra-specific variation within any of the relevant species. Indeed, the skeleton of *S. cf. capensis* is completely unknown. In most features the post-cranial skeleton of the Durban dolphin resembled that figured for the Arari dolphins. The vertebral formula, free third cervical vertebra, greater development of metapophyses, the shape of the hyoid bones and arrangement of the carpal series in the fore limb all showed a greater similarity to the Arari specimens than to the *Atlantide* dolphin. As in the skull, however, the skeleton of the Durban dolphin had certain other characters apparently unlike either the Arari or *Atlantide* specimens, notably in the development of the sternum and associated sternal ribs.

Until more information on the external appearance and skeleton of the *Stenella* species around St. Helena is available, it seems that the Durban dolphin must be referred to *Stenella attenuata* (Gray, 1846). As such, it is the first specimen of the species to be recorded from South Africa since the type skull of *Steno capensis* was sent to the British Museum in 1865 by E. Layard of the South African Museum (Gray, 1866). This skull, the locality of which was recorded as the Cape of Good Hope, has subsequently been included in *Prodelphinus attenuatus* by Flower (1885) and True (1889), and in the *Stenella attenuata* group by Fraser (1950). To date, these two specimens represent the only records of *S. attenuata* from South African seas.

ACKNOWLEDGEMENTS

I am indebted to the Trustees of the Oceanographic Research Institute, Durban, for presenting the dolphin to the South African Museum, so enabling me to examine it, and also for their permission to publish this paper.

I must also thank Professor C. J. Uys of the Pathology Department, University of Cape Town Medical School, for undertaking a post-mortem examination of material collected from the dolphin, and Mr. Sidney Kanne-meyer of the South African Museum for preparing the skeleton and photographing it.

Dr. F. C. Fraser of the British Museum (Natural History) was kind enough to read and comment on this manuscript.

The Trustees of the South African Museum thank the South African Council for Scientific and Industrial Research for a grant in aid of publication.

REFERENCES

- FLOWER, W. H. 1885. *List of the specimens of Cetacea in the zoological department of the British Museum.* London: British Museum.
- FRASER, F. C. 1950. Description of a dolphin *Stenella frontalis* (Cuvier) from the coast of French Equatorial Africa. *Atlantide Rep.* 1: 61-84.

- FRASER, F. C. 1966. Comments on the Delphinoidea. In Norris, K. S., ed. *Whales, dolphins and porpoises*: 7-31. Berkeley; Los Angeles: University of California Press.
- GRAY, J. E. 1846. On the cetaceous animals. In Richardson, J. & Gray, J. E., eds. *The zoology of the voyage of H.M.S. Erebus and Terror*. **1**: 13-53. London.
- GRAY, J. E. 1866. Notices of a new genus of delphinoid whales from the Cape of Good Hope, and of other cetaceans from the same seas. *Proc. zool. Soc. Lond.* **1865**: 522-529.
- NISHIWAKI, M., NAKAJIMA, M. & KAMIYA, T. 1965. A rare species of dolphin (*Stenella attenuata*) from Arari, Japan. *Scient. Rep. Whales Res. Inst., Tokyo* **19**: 53-64.
- OHSUMI, S. 1964. Comparison of maturity and accumulation rate of corpora albicantia between the left and right ovaries in Cetacea. *Scient. Rep. Whales Res. Inst., Tokyo* **18**: 123-148.
- TRUE, F. W. 1889. Contributions to the natural history of the cetaceans. A review of the family Delphinidae. *Bull. U.S. natn. Mus.* **36**: 1-191.